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# ***JPRS Report***

# **China**

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## ***SCIENCE AND TECHNOLOGY***

# Science & Technology CHINA

JPRS-CST-89-016

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24 August 1989

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### Chief Designer Discusses F-8 II, Future Aircraft

40060206 Beijing GUOJI HANGKONG  
[INTERNATIONAL AVIATION] in Chinese No 5, May  
89 pp 6-8

Article by Wang Yawei [3076 0068 0953]

[Excerpts] Gu Songlen [7357 6139 5358], commonly known as Chief Gu, is a famous Chinese aircraft designer. He was born in 1930 in Suzhou City, Jiangsu Province; in 1951 he graduated from the Department of Aeronautical Engineering of Jiaotong University in Shanghai. After 1956, when he began his career in aircraft design, he participated in the design of aircraft such as the F-6 and the PL-6 trainer aircraft. In 1964, he was appointed deputy chief designer for the F-8 supersonic fighter, in charge of aerodynamic and overall design. In 1981, he was promoted to chief designer for the F-8 II program. Currently, he is the associate director of the Science and Technology Research Institute of the Ministry of Aeronautics and Astronautics Industry; he is also a guest professor at the Beijing University of Aeronautics and Astronautics.

Although Chief Gu has been a well-known star in aircraft design circles, his name was not familiar to the general public until the last 2 years. On New Year's Eve, Chief Gu accepted a special interview in his office with reporters from "Military World" magazine. During the nearly 2-hour interview, he covered a wide range of topics. In particular, he spent considerable time talking about the F-8 II aircraft; some of the information he revealed was not commonly known to the public. Chief Gu's analysis of fighter technology of the 1990's and his views on the weapons systems of the Chinese Air Force were so vivid that they made a deep impression on the reporters.

With the consent of Chief Gu and the editorial department of "Military World," the contents of this interview are reprinted here for the benefit of our readers.

#### The Objective of the F-8 II Aircraft Is to Enhance Combat Capability

The conversation with Chief Gu naturally started from the F-8 II aircraft. Development of the original F-8 aircraft began in 1964; it had an aerodynamic configuration similar to that of the F-7, with the exception of the twin engine design. The primary design requirements were to achieve superior high-altitude and high-speed performance, as well as increased range and higher climb rate. Its design was completed in 1966, and the first protoflight took place on 5 July 1967; the aircraft has now been delivered for military service. The development path of the F-8 prototype was a rocky one because of the political turmoils during the 10 years of cultural revolution. The F-8 II is a new fighter aircraft based on the F-8 prototype; its maiden flight took place on 12 June 1984. Its design is now finalized and has been released for production.

The main difference between the F-8 II and the F-8 prototype is that the former has much improved combat capability. This is reflected by the following modifications to the aircraft:

1. The forward fuselage has been re-configured for two side air intakes to provide space for a larger, new radar antenna.
2. A new engine with higher thrust is used in place of the old engine.
3. Two exterior attachments are installed to accommodate medium-range missiles or bombs for enhanced air-combat and air-to-ground attack capabilities.
4. A new aiming device has been installed.
5. The electronic countermeasure capability of the aircraft has been enhanced to improve its survivability in today's environment of electronic warfare.
6. An autopilot has been installed.

#### F-8 II Superior to the MiG-23 in Overall Performance

In comparing the F-8 II with other fighter aircraft around the world, Chief Gu indicated that the F-8 II is superior to the MiG-23 in both subsonic and supersonic performance. It is also superior to the U.S. F-16 and the French Mirage-2000 in terms of supersonic performance, but inferior in terms of high-subsonic mobility. He believed that the F-16 has outstanding mobility in the high-subsonic regime, but lacks supersonic combat capability; the F-8 II on the other hand, has a more balanced design, its maximum Mach number and ceiling both exceed those of the F-16 by a wide margin.

With regard to the problem of high-subsonic mobility, Chief Gu explained that in order to preserve good supersonic performance, the F-8 II uses a small-aspect-ratio, delta wing design, which inherently has poor mobility in the high-subsonic regime. He also pointed out that China lags far behind Western countries in onboard avionics; for example, our radar is heavier and has shorter range than the radars developed by advanced countries. It has been suggested to install advanced electronic equipment on the F-8 II, but the cost would be very high.

#### F-8 II Is an Exclusive Product of China

During the conversation, Gu was asked if imported technology had been used in the development of the F-8 II. His reply was a firm "no." He said: "The F-8 II is an exclusive product of China. No foreign technology was directly applied in its development; the only technical information provided by other countries was obtained from open literature." Chief Gu went on to give a detailed account of the innovative spirit and the persistent efforts of the F-8 II research team under his leadership. For example, the F-8 II has a conical twist wing design to increase its range. The most difficult problem was the design of the side air-intakes, which took nearly

10 years. The current intake design has superior subsonic and supersonic performance; it also has a relatively simple regulator system for the supersonic air intake.

#### **The F-8 II Still Has Room for Improvement**

On the topic of future improvements for the F-8 II, Chief Gu had the following comments:

"Based on current assessments, the F-8 II is a good weapons system; there are design margins in both the structural strength of the aircraft and in payload weight. The primary focus for future improvement should be to supplement its inadequate mobility in the high subsonic region."

Specifically, Gu believes that improvements can be made in the following four areas:

1. High subsonic mobility can be improved by using a variable-camber wing design. In particular, we can install a leading-edge slot or flap, and use the trailing-edge flap not only for take-off and landing but also for maneuvers during transonic flight. It is estimated that a 20-30 percent improvement in mobility can be achieved.
2. Efforts should be made to develop an engine with the same dimensions but with higher thrust-to-weight ratio.
3. The number of exterior attachments should be increased in order to improve the combat effectiveness of the aircraft.
4. Highly integrated, computer-controlled electronic equipment should be used; they include advanced radar system, exterior attachment control system, and fire control system.

While Chief Gu was confident about realizing these improvements on the F-8 II, he did point out that they are dependent on China's ability to raise its overall industrial standards. For example, it would be difficult to improve the performance of the onboard electronic system without raising the standards of our electronics industry.

#### **F-8 II Has Export Potential**

In discussing the prospect for exporting the F-8 II aircraft, Chief Gu was quite optimistic. He pointed out: "Although this aircraft was developed primarily for the Chinese Air Force, we have no objection to exporting it to other countries."

"The F-8 II's performance is comparable to the fighter aircraft of the United States, the Soviet Union, and France, but its cost is lower because it does not have the extra equipment which do play a direct role in combat. The target countries for export of course are the developing countries. Most developed countries have their own fighter aircraft or their traditional suppliers; they would not easily give up this market. The developing countries which purchased the F-6 and F-7 aircraft from us are now facing the problem of upgrading their

fighters, and the F-8 II is a perfect replacement. Therefore, we should seize this opportunity."

As to how we should promote and expand F-8 II's export market, Chief Gu offered this suggestion: "First, we should ask our most skilled technical personnel and pilots to advertise and demonstrate the advanced characteristics of the F-8 II to foreign customers so more potential customers will become aware of this state-of-the-art Chinese fighter. The F-8 II model to be exported may have either Chinese-made onboard equipment or at the purchaser's option, equipment made by other countries." He believed that with a good advertising and marketing effort, the F-8 II has a promising prospect for future export.

#### **Fighter Aircraft for the Future and Over-the-Horizon Fighter Aircraft**

When the conversation turned to fighter aircraft for the future, Chief Gu said: "Today's aircraft designs, combat strategies and tactics are changing rapidly, but they all depend on the progress made in new technologies. With the rapid development of electronics and propulsion technologies, future air combat tactics will shift from today's close-range combat to over-the-horizon and medium/long-range combat. This would require future fighter aircraft to maintain supersonic flight for longer durations and to have good supersonic mobility. These are the essential qualities to succeed in over-the-horizon combat." He then gave some specific examples of the technical requirements for a future fighter aircraft:

- The aerodynamic design must first satisfy the requirements of supersonic performance; the aircraft will generally have a slender body with significantly higher lift-to-drag ratio: from 3-4 for today's fighter aircraft to 6-7.
- It must be equipped with a high-performance, long-range radar and long-range missiles in order to ensure first detection and first strike capability. The missile must be able to strike in any direction to allow the aircraft to vacate the combat zone immediately after the strike.
- It must preserve good subsonic performance to provide close-range combat capability in case a low-velocity combat situation arises; the subsonic mobility must be enhanced by one order of magnitude compared to today's aircraft.
- It must have highly reliable engines with thrust-to-weight ratio of the order of 10; it must be able to operate at large angle-of-attack, large bank angle, and under extremely poor flow field conditions around the air intake. Furthermore, its fuel consumption must be low.
- It must be easy to operate and maintain in order to achieve a high in-service rate. This requires simplifying the manufacturing process, reducing cost, and increasing productivity.

- It must have short take-off and landing capability. Generally, the landing distance required by a slender aircraft is over 1,000 m; we must reduce the landing distance to below 300 m to ensure that the aircraft can still operate when the airfield is partially destroyed by bombing.
- Its radar signature and infrared signature must be kept to a minimum to provide good stealth capability during an over-the-horizon combat. This will require significant changes in the design of its aerodynamic configuration.
- The engine must have the capability to change its thrust direction. This is required to provide adequate mobility in a subsonic, large angle-of-attack combat situation where the dynamic pressure is too low to maneuver the aircraft aerodynamically.
- The cockpits of future fighter aircraft will be equipped with a large screen where measured information of both enemy aircraft and friendly aircraft are displayed. This information will be analyzed by a computer to indicate what the optimal course of combat action should be. In other words, the pilot will be replaced by a computer with expert system and artificial intelligence capability in making combat decisions.

#### **Key To Developing Weapons Systems for the Chinese Air Force Is To Emphasize Preliminary Research**

In response to a question by this reporter on the key to developing future weapons systems for the Chinese Air Force, Chief Gu replied emphatically: "The only way is to rely on ourselves and to strengthen our preliminary research programs in the new technology areas."

He said: "It has been 10 years since China initiated reforms in its government and the open-door policy; during this 10-year period, we have gained access to many things which were unavailable to us before. However, our experience has shown that we cannot achieve first-rate aviation technologies by importing or purchasing from other countries; the technologies and equipment given to us were already obsolete. For example, in the late 1970's, China's minister of aviation industry and his delegates were invited to France for a tour, but he was not allowed to see the Mirage-2000 which was under construction; only a model of the aircraft was given to him. Of course, we should take advantage of the current opportunity and try to import foreign technologies on a selective basis. But in the final analysis, we must rely on ourselves."

"To rely on ourselves, we must emphasize preliminary research in key technology areas. To transform these technologies from the laboratory to the real world is a difficult task that requires years of dedicated work and repeated experimentation. Furthermore, to implement these new technologies requires integrated tests before they can be used on a new aircraft."

In view of China's limited economic and technical resources, clearly it is not possible to initiate research programs in all the new technology areas needed by future fighter aircraft. In Gu's opinion, our priorities should be in the following areas:

1. Develop engines with large thrust-to-weight ratio and low fuel consumption;
2. Develop state-of-the-art avionics equipment such as pulse-doppler radar with look-down capability and high target-resolution capability;
3. Accelerate the development of advanced medium-range missiles;
4. Develop an automated active control system for operating the aircraft so the pilot can concentrate on his combat activities;
5. Develop new materials and increase the use of composite materials to reduce the weight of the aircraft.

It is Chief Gu's sincere hope that a cooperative effort between China's military services and industrial organizations can be initiated to establish a comprehensive plan for developing future weapon systems for the Chinese Air Force. He told this reporter that the current thrust of the Science and Technology Research Institute of the Ministry of Aeronautics and Astronautics Industry is to conduct preliminary research in advanced aviation technologies, and that he would personally like to devote more of his time to preliminary research. [passage omitted]

#### **Studies of Physiological Critical Index of Rhesus Monkeys During Exposure to Transverse Acceleration Force**

40090074a Beijing KONGJIAN KEXUE XUEBAO  
[CHINESE JOURNAL OF SPACE SCIENCE]  
in Chinese Vol 9 No 3, Jul 89 pp 195-205

[English abstract of article by Zhang Shufu [1728 3219 7346], Wu Zhenrong [0702 7201 2837] et al., of the Department of Biology, Fudan University, Shanghai]

[Text] Ten rhesus monkeys (*Macaca mulatta*) were exposed to a 16G hypergravity force, with their respiratory rates and EEGs continuously recorded. Under the 16G action, the respiratory rates of all the monkeys first increased, then slowed, almost ceasing by the end of the centrifugation. The heart rate showed an initial increase (70 percent of the monkeys), then a gradual decrease, with arrhythmia, heart block, etc., occurring sometimes. The brain waves appeared to be mainly "delta" waves with high amplitude and low frequency. The wave amplitude fell gradually, accompanied by the appearance of 4-6 c/sec "theta" waves with small amplitudes. Not until the EEG disappeared was the centrifugation stopped.

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#### Observation, Preliminary Analysis of Development of *Artemia* Eggs Recovered from Satellite 8799

40090074b Beijing KONGJIAN KEXUE XUEBAO  
[CHINESE JOURNAL OF SPACE SCIENCE]  
in Chinese Vol 9 No 3, Jul 89 pp 221-225

[English abstract of article by Zhou Qiling [0719 0796 3781, He Jian [0149 1696] et al., of the Institute of Biophysics, Chinese Academy of Sciences, Beijing]

[Text] Eggs of the Chinese native brine shrimp *Artemia salina* were carried by the satellite "8799." The total dose of ionizing radiation received by the eggs during the eight-day space flight was about 169 mrad. The eggs were initially incubated in artificial sea water and were observed, along with the ones of the lab control and launching site control groups, on days 21-29 '96 and 155 following the flight. The main results are as follows: (1) It was observed again that a significant delay in emergence and hatching occurred in the flown eggs, with the extent of this delay apparently being gradually reduced during prolongation of egg storage at 42 °C. (2) The hatching rate of the flown eggs and the survival curve, within 21 days, of larvae hatched from the flown eggs were very similar to those observed in the earth control groups. (3) In the ground experiments involving super-gravity simulation (up to 160 g), no obvious effects on development were observed. The necessity of two control groups (one retained in the lab and the sent to the launching site)

parallel to the space flight samples is emphasized, and the importance of the effect of micro-gravity during the space flight is presumed.

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#### Temperature Problem of Solar Panel of Spacecraft in Orbit

40090074c Beijing KONGJIAN KEXUE XUEBAO  
[CHINESE JOURNAL OF SPACE SCIENCE]  
in Chinese Vol 9 No 3, Jul 89 pp 226-232

[English abstract of article by Tang Lingli [0781 0134 0196], Zhu Lianfang [2612 6647 5364] et al., of the Center for Space Science and Applied Research, Chinese Academy of Sciences, Beijing]

[Text] The basic equations of energy equilibrium of solar panels in several typical heat environments and the equations for the space heat radiation angle coefficients are obtained by the principle of energy equilibrium. The angle coefficients and the maximum temperature fluctuation are obtained for a solar panel in different orbits by the method of numerical integration. After this temperature effect has been studied, the intrinsic frequency characteristics of the solar panel are analyzed and calculated by the finite element method. The results show that the effect of the dynamic characteristics of the spacecraft's solar panel during orbits between shaded and sunlit areas cannot be ignored.

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### Study of Toxicological Mechanism of Moniliformin

40091034a Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 29 No 2, Apr 89 pp 93-100

[English abstract of article by Zhang Hong [4545 4767], Li Jilun [2621 1323 0243] et al., of the College of Biological Sciences, Beijing Agricultural University]

[Text] A mycotoxin has been extracted from a strain of *Fusarium moniliforme* var. *subglutinans* isolated from moldy corn seeds harvested from a region of Shaanxi Province that was seriously infected by Keshan disease and purified. The purification procedure involves water extraction, ion exchange chromatography, desalination and crystallization. Its UV spectrum, IR spectrum and NMR are identical with those of the moniliformin. The toxin is highly toxic to young Beijing ducklings. The electrocardiogram (ECG) of the duckling changes immediately following feeding with moniliformin.

The cardiac muscle cells of Beijing ducklings are injured by the toxin. The toxicity may be alleviated to a certain extent by applying an adequate dosage of selenium ( $3.18 \times 10^{-10}$  mol/L of  $H_2SeO_4$ ) prior to the moniliformin treatment. The permeability of the cardiac muscle cells of the rats and young ducklings is damaged posterior to the injection site of the toxin as tested by the extracellular macromolecular tracer (HRP) method.

The relationship between moniliformin and Keshan disease is discussed. The authors believe that the moniliformin may be the causal agent of the disease.

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### Use of Baculovector for Expression of HBsAg Gene in Insect Cells

40091034b Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 29 No 2, Apr 89 pp 101-106

[English abstract of article by Qiu Bingsheng [6726 1629 3932], Pei Meiyun [5952 5019 0061] et al., of the Institute of Microbiology, Chinese Academy of Sciences, Beijing; Lu Haoying [6629 1170 5391], et al., of the Institute of Basic Medical Sciences, Academy of Military Medical Sciences, Beijing]

[Text] Based on the information of the molecular biology of the Autographa californica Nuclear Polyhedrosis virus (AcNPV), a recombinant transfer plasmid pAcMV has been constructed by molecular procedures involving the use of two synthetic localized probes, providing an inserted position linked with *Bam*HI sequences nearly at the polyhedron initiating the ATG codon. Then an expression vector pAcMV-HBsAg was reconstructed that congaigned the HBsAg gene from the subclone pYPSS-1 derived from the adw-serotype of HBV. The recombinant virus containing the HBsAg gene was isolated and purified through three cycles of plaques and a hybridization experiment following the cotransfection of *Spodoptera frugiperda* cells with DNA of pAcMV-HBsAg and AcNPV.

The expression of the HBsAg gene in the *S. frugiperda* cells infected with the recombinant virus AcRV-HBsAg has been identified by ELISA through hemagglutination tests. The yield of HBsAg excreted from *S. frugiperda* cells (an appropriate density usually ranges from  $1$  to  $2 \times 10^6$  cells per ml) 48 to 72 hours after being infected with AcRV-HBsAg is 4 to 8 mg/L. The HBsAg harvested from the infected culture medium has been shown through immunoelectronmicroscopy to be composed of spherical particles about 22 nm in diameter. Using this purified HBsAg, Bal b/c mice were immunized, and the titer of the anti-HBsAg serum measured by RIA was similar to that of purified HBsAg from human blood. A stable recombinant virus has been isolated and shown to replicate in corn borer (*Ostrinia nubilalis*) larvae. All of these results indicate that this expression vector system

will be commercially developed to its fullest potential for the diagnosis and vaccine for HBsAg.

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### Subcloning of K88ac Antigen Gene of Enterotoigenic *E. coli*. Restriction Map of Recombinant Plasmid

40091034c Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 29 No 2, Apr 89 pp 113-116

[English abstract of article by Zhang Linyuan [1728 2651 0337], Li Shude [2621 3219 1795] et al., of the Institute of Military Medicine, Nanjing Command PLA]

[Text] The authors report a recombinant *E. coli* RR1(pNZ8801) obtained from the wild strain *E. coli* 79-1454. The recombinant plasmid was digested by *EcoRI* and generated three segments. The medium segment (3.2 Md) was removed, the largest and smallest were ligased, and then the mixture was transformed into *E. coli* RR1. Upon screening the Ap<sup>r</sup> Tc<sup>s</sup> *E. coli* RR1(pNZ8802). The recombinant plasmid's molecular weight is less, but the expression of the K88ac antigen is higher than that of the first cloning. Subcloning can adhere to the mucosae of a piglet's intestines. Therefore the recombinant can be used for an oral living vaccine.

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### Preliminary Study of Mutant Strain of *Azospirillum Brasilense* (CWV-22) Raising Amount of Nitrogen Fixation in Wheat

40091034d Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 29 No 2, Apr 89 pp 137-140

[English abstract of article by Luo Xiaoyang, [5012 1321 2254], Jiang Yaping [5592 0068 1627] et al., of Wuhan Institute of Virology, Chinese Academy of Sciences, Wuhan; Yan Jiaqi [0917 1367 7496] of Wuhan University; Chen Huagui [7115 5478 4097] of Huazhong University of Agriculture, Wuhan]

[Text] The combinant of an *Azospirillum brasilense* mutant (CWV-22) with wheat fixed nitrogen has been tested by using both a pure culture and a hermetic cultural apparatus. On the basis of these experiments, potted culture (sand culture) was conducted. The results showed that, in the absence of  $\text{NH}_4^+$ , when the combinant of wheat with the mutant strain CWV-22 was compared to that of wheat with strain Sp7, the nitrogen content per gram of dry matter of the wheat seedlings of the former was 2.1 times that of the latter. In the presence of 30 mmol/L  $\text{NH}_4^+$ , the nitrogen content of the former was about 46 mg higher than that of the latter, while in the presence of 30 mmol/L  $^{15}\text{NH}_4^+$ , the amount of  $^{15}\text{N}$  absorbed by the combinant of wheat with strain CWV-22 was 13  $\mu$  higher than that of the combinant of wheat with strain Sp7.

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**Restriction, Modification in Gram-Negative Thermophilic Bacterium, Isolation of Restriction Endonuclease TspA I**

40091033a Shanghai FUDAN XUEBAO [JOURNAL OF FUDAN UNIVERSITY—NATURAL SCIENCE] in Chinese Vol 28 No 1, Mar 89 pp 96-101

[English abstract of article by Chen Zhongfu [7115 0022 1318], Yang Ruirong [2799 3843 5554] et al., of the Institute of Genetics]

[Text] A restriction endonuclease TspA I has been isolated from the gram-negative and flagellate thermophilic bacterium FD230. TspA I functions upon phage p228 in terms of restriction and modification. By cleaving  $\lambda$ DNA, pBR322DNA and  $\phi$ X174 RFDNA-HAE III fragments, it has been identified as a restriction endonuclease possessing the same recognition sequence as that of EcoR II, i.e., the cleavage site is CC<sup>A</sup><sub>7</sub>GG. TspA I can easily be isolated and purified. The enzyme is active over a temperature of from 30 to approximately 80°C. In addition, it has been found to be stable at 60°C for as long as 30 minutes.

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**Method of Rapid, Small-Scale Extraction of Recombinant DNA**

40091032b Shanghai FUDAN XUEBAO [JOURNAL OF FUDAN UNIVERSITY—NATURAL SCIENCE] in Chinese Vol 28 No 1, Mar 89 pp 116-118

[English abstract of article by Cao Kaiming [2580 0418 7686], Li Biyu [2621 4310 5038] et al., of the Department of Biochemistry; Zhan Shuxuan [6124 2885 5503] of the Center of Analysis and Measurement]

[Text] The in vitro recombined bacteriophage  $\lambda$  has been purified from plate stocks using DEAE-cellulose to

remove contaminated nucleic acids. After its precipitation in the presence of PEG, the pellet is lysed with SDS and extracted with phenol/chloroform. The recombinant DNA is then precipitated by adding cold ethanol to the aqueous phases. The purified DNA is of high quality, permitting restriction enzyme digestion. This procedure for the small-scale extraction of  $\lambda$ DNA is rapid and straightforward.

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**Studies of Structure, Synthesis of Arteannuin, Related Compound. XXII. Regioselective Synthesis of Arteannuin D**

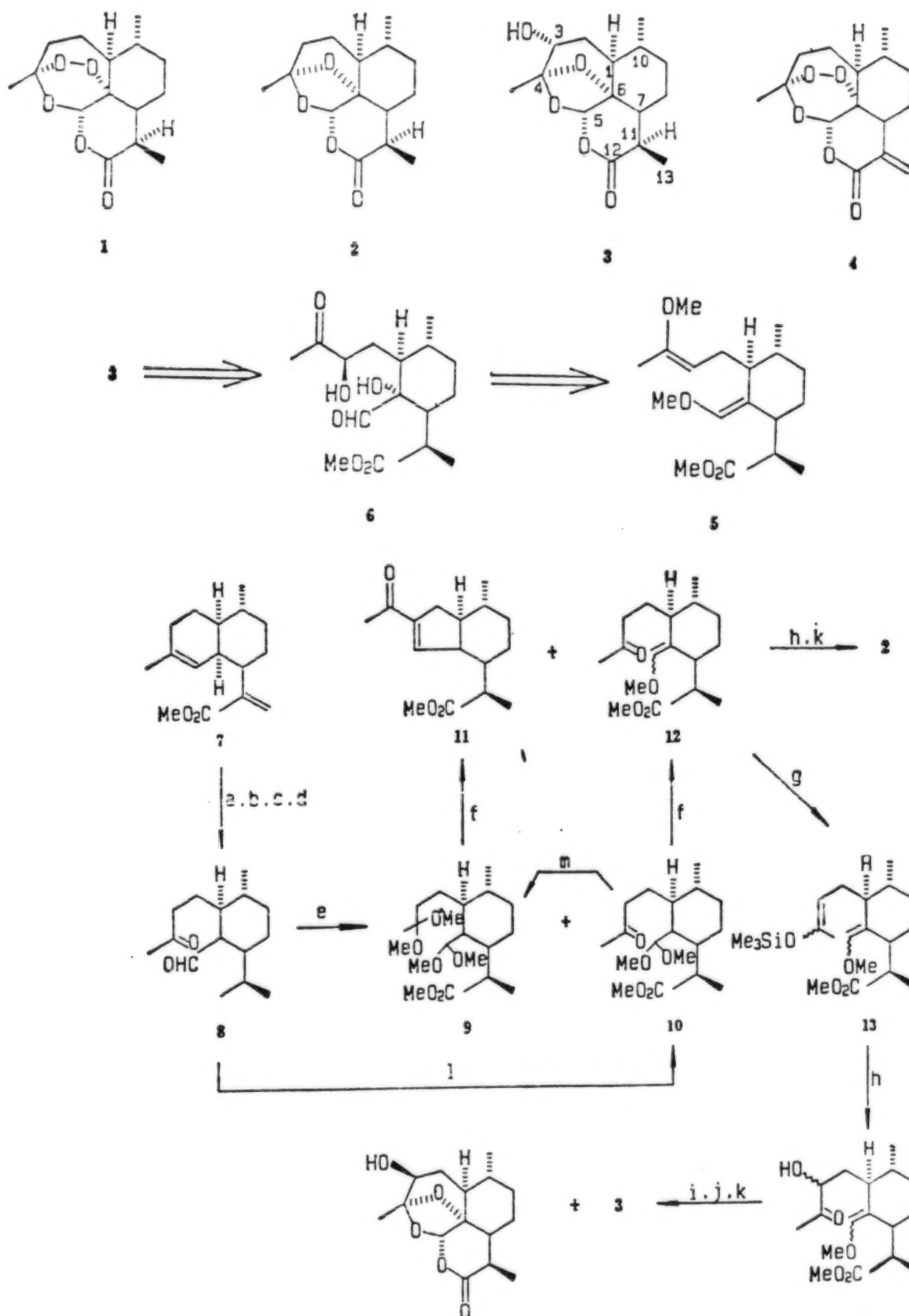
40091033c Beijing HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese Vol 47 No 4, Apr 89 pp 340-344

[English abstract of article by Zhou Weishan [0719 4850 0810], Xu Shijie [1776 0013 2638] et al., of Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences]

[Text] Arteannuin D (**3**) coexists with arteannuin (**1**), which is an antimalarial principle isolated from the Chinese medicinal herb *Artemisia annua* L. In this paper, the regioselective synthesis of **3** is reported.

The aldehyde-ketone **8** obtained from the arteannuinic acid (**7**) was treated with 1 eq trimethylorthoformate in methanol in the presence of a catalytic amount of *p*-TsOH to provide **9** and **10** in 86 percent yield in the ratio of 1 to 1, and with 2 eq of the orthoformate under the same conditions to give only **9** in 88 percent yield. However, pyrolysis of **9** in xylene did not produce the desired intermediate **5**, but instead gave **11** and **12** in yields of 34 percent and 30 percent, respectively.

Another approach to the synthesis of **3** is to use enol-silyl ether **13** obtained from **8** as a key intermediate through the following sequence of reactions: **8** **10** **12** **13** in 28 percent overall yield. Trimethylsilyl enol ether **13** was hydroxylated with *N*-methyl morpholine *N*-oxide (NMMNO) and a catalytic amount of OsO<sub>4</sub> to give the 3-OH product **14** regioselectively in 52 percent yield. On the other hand, the compound **12** was hydroxylated with OsO<sub>4</sub> and NMMNO, followed by cyclization with 10 percent K<sub>2</sub>CO<sub>3</sub>, producing deoxyarteannuin (**2**) in 72 percent yield. After 3-OH protection of **14** by acetylation, it was hydroxylated with a stoichiometric amount of OsO<sub>4</sub> followed by cyclization with 10 percent K<sub>2</sub>CO<sub>3</sub>, giving a mixture of **3** and its 3-OH epimer **15** in a 59 percent yield, which, after column chromatography, gave **3**, m.p. 190-192°C, whose spectroscopic data were identical with those reported in the literature.



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### Naval Target-Practice Simulator Goes Into Production

40080201a Beijing DIANZI SHICHANG  
[ELECTRONICS MARKET] in Chinese 25 May 89 p 1

[Article by Qin Ling [4440 1545]: "Naval Simulator Training Control System Passes Evaluation"]

[Text] The model B-9 shipborne drone control system used in naval live-ammunition practice has been developed at Northwest Polytechnical University. Having recently passed the technical evaluation held by the Military Planning Department of the Ministry of Aeronautics & Astronautics Industry, it has gone into batch production.

The shipborne drone control system is necessary instrumentation for the automation of naval training simulation.

This formerly relied entirely upon imported equipment, and with annual expenditures of millions of yuan in foreign exchange, the result was repeated arguing about supply deadlines and the quality of spare parts. In 1986 the Navy's Department of Military Training included this system in its major projects for the Seventh 5-Year Plan.

The experts felt that the design of this control system is innovative, the structure clever, and that the starting point of its technology is high. By integrating the machinery and electronics, the reliability of the control can be 100 percent. Each performance indicator meets standards of similar international products of the 1980s, and the cost is only one-half that of imported products. Use of this system can avoid various incidents that can happen during the training process, and can also reduce training expenses, shorten training periods, and produce greater economic and practical benefits.

### Visit to Beijing Machine Tool Institute

40080/200 Beijing JICHUANG [MACHINE TOOLS]  
in Chinese No. 5, May 89 pp. 14-17

[Article by Xu Honggen [1776 7703 2704]: "A Trip to the Beijing Machine Tool Institute"]

[Text] The first China International Machine Tool Exhibition will be held in Shanghai. On the eve of this event, this reporter has been sent by this journal to visit the Beijing Machine Tool Institute.

This institute was built in 1956 and is now affiliated with the Ministry of Machine-Building and Electronics Industry (MMEI). It employs more than 2,000 people among whom about 800 are engineering and technical personnel. Subordinate to the institute are more than 10 laboratories, such as those for machining centers, ultra-precision machine tools, three-dimensional measuring machines, numerically controlled (NC) systems, servo-pulleys, pneumatics, hydraulics, robotics, electronic machining, raster digital displays, rolling function components, casting, heat-processing techniques and equipment, mechanical machining techniques, computer applications, and machine tool standards. This is the production base for the Beijing Precision Machine Tools Plant and the Beijing NC Equipment Plant, and to which are also affiliated the NC Machine Tools Training Center, the NC Technology Development Center, and the Pneumatic Technology Training Center. The China Machine Tools Product Quality Monitoring and Inspection Center, and the China Mechanical Engineering Society and Production Engineering Professional Society are also registered at this institute.

Within the machine tool industry, this institute serves the functions of innovation, advising, organization, and service. In the more than 30 years since the institute was founded, it has accomplished more than 1,100 scientific research achievements. In the year 1988 alone, more than 50 research achievements resulted, and the rest of this paper will describe several among them.

#### 1. JSC-FMS-1 Servomotor Machining With the Flexible Manufacturing System (FMS)

This is the first demonstration rotational-solid parts flexible machining system in China. Construction began in 1984 and trial production began in 1986. The system is used to machine 12 components for servomotors, and has an annual machining capacity of more than 5,000 units. The entire system is composed of the following units: five domestically manufactured NC machine tools (the Star-Turn 1200 NC lathe from the Shenyang Third Machine Tools Plant, the H160/1 NC cylinder end-face grinder from the Shanghai Machine Tool Plant, the CK7815 NC lathe from the Great Wall Machine Tool Plant, the JCS-018 vertical machining center from the Beijing Precision Machine Tool Plant, and the XH754 horizontal machining center from the Qinghai First Machine Tool Plant), four robots, five machine tool front workpiece pallet stations, and fifteen warehouse

workpiece pallet stations and central management systems, physical flow control systems, and monitoring systems. During the 2-year-plus process of trial operation and production, through improvement of the system and secondary development, the institute has trained a contingent that has fundamentally mastered the overall techniques for developing an FMS. This system passed a 1988 professional review arranged by MMEI.

#### 2. Research on Cycloidal Rotor-type Surface Slow-Feed Force Grinding Integrated Technologies

This project passed its ministry-level evaluation in 1988. The specifications they achieved were: profile accuracy of 9-13 microns base tangent length changes of 5 microns, face roughness of  $R_a$  0.7-0.95 micron, and an improvement in productivity over series machining of 5-10 times. Accuracy indexes are now approaching the same levels of foreign forming slow-feed grinding [machine tools].

#### 3. Boring-Mill Machining Center Heat-Error Real-Time Compensation Technology

At this time when automation has progressed so far, the effect of machine tool heat-forming on machining precision is getting more and more attention. The outstanding features of this project that have been realized most recently include: 1. The ability to do three-dimensional linked heat displacement compensation, with simultaneous automatic compensation for linear displacement, there can also be automatic compensation for angle displacement according to different lengths of the tool-bar; 2. Through real-time temperature checking during machining, the ability to provide non-linear handling of heat displacement, which improves compensation precision; 3. The development of three-dimensional heat-error compensation function boards, used to directly link up with the machine tool NC system; there is therefore no need to further set up special heat compensation facilities.

#### 4. Machine-Tool Electromagnetic-Clutch-Components Laser Quenching Technique and Applied Research

The primary achievements of this project have been to: 1. Prepare a new type of absorbent coating material that produces such results as quenching in layers, little surface roughness, little flame when quenching, and a coating depth which permits a larger passive range, thus making the coating convenient and cheap; 2. Recommend 10 kinds of parameters for laser quenching techniques for steel, and establishment of a small database; 3. Develop special programs to avoid melting when initializing and terminating quenching over the orbiting track, thereby resolving the technical difficulty when fine gear teeth are being quenched and the tips melt, the angle between them being lost. When these technical achievements are used for quenching clutch connecting pieces, productivity is greater, there is less energy consumption, and the quality of quenching is good.



### 5. Development of the JCS-035 Ultra-Precision Lathe

The ultra-precision lathes seen up until now are all basically only suitable for the machining of nonferrous metals. This lathe was developed to satisfy the requirements of ultra-precision ferrous-metal machining. The primary functions and characteristics of this machine tool are: 1. This is a CNC [computer numerically controlled] ultra-precision lathe that can jointly control two coordinates; it is suitable for use in semi-precision machining, precision machining, and ultra-precision machining of surfaces, cylindrical surfaces, inside and outside spherical surfaces, and for various kinds of non-cylindrical rotary components. Machining precision can reach: roundness, for ferrous metals 0.34 micron and for non-ferrous 0.24 micron; surface roughness, for ferrous metals  $R_a$  0.23 micron, and for non-ferrous metals  $R_a$  0.05 micron. 2. The main bearings use special air hydrostatic bearings, with diameter run-out less than 0.2 micron, 2 hours after turning on the machine, shaft extension is less than 1 micron. 3. In addition to a square tool frame (X, Z), there is also a 360-degree rotational tool frame (W, A) mounted on a high-precision air-liftation workstation; it also uses an end-bracket with a square sleeve structure. 4. A high-precision three-jaw chuck and a suction-plate device may be mounted on the main bearing end. 5. Constant-linear-speed stock removal can be done over the range 50-1,000 rpm. Balanced feeding can be done at a speed of 0.1 mm/min at any rotation. When the circumference is  $R$  125 mm, radial balanced feeding can be done at a speed of 0.005 mm per revolution. 6. Using the FANUC-BESK6M NC system, four coordinates can be controlled (X, Z, W, A), and X can be moved with Z or W with A. 7. Four tool-frame coordinates all use the inertial DC servomotor driver in the FANUC-BESK, with a short drive chain. This lathe has now passed a full-scale performance test done by the China Machine-Tool Performance Testing Center.

### 6. Completion of the Transformation of the DJK-BS 02B Single-Shaft NC System Into a Commercial Product

This system is primarily used for coordinate setting and precision division control in drilling machines, punch presses, shears, grinders, and rotary tables. Structurally, there are the two types: separated and standard. By 'separated' is meant there is no cabinet involved, and only the functional parts are supplied in accordance with the needs of the customer. The greatest features of the system are its small size, low price, and ease of installation and maintenance. This single-shaft NC system incorporates the following functions: general-purpose digital display, editing, automatic and manual operation, single-segment operation and skip program segment, three steps and five feed-doubling choices, automatic cycling, automatic zeroing, automatic speed changing, back clearance compensation, and DI autodiagnoses. This system can also be used on-line with the FANUC-BESK 3M 3T system.

The institute has also completed a project called "Research on Machining-Center Test Modality Analysis and Ways to Recognize Its Vulnerable Links," which not only makes valuable suggestions for the structural design of vertical machining centers, but has also produced some innovative developments regarding techniques for experiment modality analysis. The project entitled "Applying Laser Holographic Technology to the Study of Rational Structures and Parameters for Machining-Center Upright Post and Mainbearing Casings" has successfully used high-power lasers to do direct laser holographic testing of machine-tool large component structures and patterns, from which they have obtained high-quality holographic images. The experimental results obtained using the methods from this research can be used as proof for finite-element and calculations. Results from the "Gear-Tooth Gas SCN [sulfur-carbon-nitrogen] Combined Infusion Technique and Its Performance" project has not only laid a good foundation for the use of this technique on non-clashing gears, but has also proposed measures for reducing gear handling and forming. Through "Research on Caliper Frame and Body Surfaces and on Spline Buffered Feed and Mold Grinding Techniques," buffered feed and mold grinding techniques have been formally applied to large-scale production of calipers, which has improved productivity and product quality and has created new ways to change domestic caliper production. Also, the "Machine Tool Linear Uniformity CAT Test System" that just passed its evaluation at the end of 1988 enables the HP5526A Double-Frequency Laser Interferometer System to be a measuring facility, accurately and dynamically checking the signals of the machine tool linear motion. By sending [the data] to a microcomputer for processing it can plot or print out (on plotters and printers) the displacement-time curves, speed-time curves, and displacement differential-time curves that express motion homogeneity, and it can also output the values of the corresponding parameters. The highest resolution of the system is 0.1 micron. This achievement can now be used in actual testing. Development of the "Model QGZ Magnetic Non-Piston Rod Cylinder" and the "Gas-Liquid Mixture Execution Cylinder" into a series of commercial products has also been completed, and batch production has begun at the Shanghai Hydraulic Components Plant No. 3.

In addition to the projects just mentioned, the following primary projects will also be exhibited at the China First International Machine Tool Exhibition:

#### 1. The XH715A Vertical Machining Center

This product was developed by this institute on request from a foreign firm, and it is now on the market in North America. The outstanding features of this machine tool are great torque, a large stroke, and high revolution. Regarding structure: the main shaft is gear-driven by an adjustable motor, with a grouping of special bearing supports, and it also features temperature-controlled oil lubrication and a cooled main-shaft casing, and there is low noise (less than 78 dB for the entire machine) and

little heat deformation. Polymer plastic surfaces are used for the guides, which are cushioned and non-corrosive; for the tool-changing facilities adjustable-clearance driver structures and independent position-control systems are used, and tool changing is smooth, steady, and reliable. This machining center is controlled by the FANUC-BESK 6M CNC system; it has self-diagnostic functions, and also has the easy-to-operate CRT/MIDI display device. Its chief parameters are as follows:

Workstation dimensions—1,360 X 550 mm

X/Y/Z travel—1,200/510/550 mm

Main shaft rotation speed: DC adjustable motor, 20-3,800 rpm; or AC adjustable motor, 25-5,000 rpm

Rapid traverse speed X,Y, 15 m/min; Z, 10 m/min

Tool magazine capacity, 20

Positioning precision, + over - 0.012/300 mm

Repeat positioning precision, + over - 0.006 mm.

## 2. The BS 04 M/G NC System

This is an all-function NC system produced by this institute over the last 2 years. The model M is a 3-coordinate coupled-control CNC system developed for such machine tools as milling machines. Because it uses a high-speed microprocessor and application-specific LSI circuits, it has few circuit components and is highly reliable. Because its surface area has been made quite small, it can be fitted into a strong electronic cabinet at the side of the machine tool. In addition, there is also a programmable controller (PC) installed in the system that greatly simplifies the machine tool interface as it provides some 2,000 sequential program steps, 104 data input points, and 72 data output points. In addition to displaying letters, the system display device can also show Chinese characters and graphics.

The model G is a new product developed for cylindrical external-surface grinders. During its design, consideration was made of the characteristics of grinders and grinding machining, which has led to control of grinding precision to 0.1 micron. This system can also be used for intercylinder grinding and other grinding. Primary technical specifications and functions: capable of 3-coordinate linked control; has linear and circular-arc insert supplement functions; has two pulse equivalents, 0.1 micron and 1 micron; feed rate is 0.01-2,400 mm/min or 0.1-15,000 mm/min; has idle-stroke removal function; provides arbitrary selection of component coordinate system and grinding wheel coordinate system; has automatic tool alignment; has grinding-wheel correction cycle functions (four) and automatic compensation for quantities removed during correction; has constant-linear-speed grinding control; has grinding cycles (six) and a grinding-wheel life-management function; has grinding-wheel overload protection and chuck restricted-zone protection; has bevel-angle control, fast retraction, and a user macroprogram library.

## 3. The SJ-III Multi-Functional Dual-Frequency Laser Interferometer

This is one of the measurement instruments newly developed by the institute. In addition to its use in measuring length, small angles (flat), and linear angles, it can also be used to dynamically test the accuracy of linear ripple dimensions, raster dimensions, magnetic grids, and induction synchronizers, and it can also be used to dynamically control the engraving of rasters, magnetic grids, and induction synchronizers. The complete instrument set is composed of a frequency-stabilized laser head, a tripod, a microcomputer, a CRT display device, a graphics printer, and a disk drive. The primary technical specifications of the instrument: when used for testing length, accuracy is + over - 0.3 micron/m, resolution is 0.158 micron, allowable shift rate -18 m/min, maximum test range -30 m; when used to measure small angles (flat), accuracy is + over - 0.3 percent of the display value + over - pulse equivalent, test range is + over - 2,000," and resolution is 0.1"; and when used to measure linearity, accuracy is + over - 3.5 percent of the display value + over - pulse equivalent, resolution is 0.16 mm, maximum test range is 3 m, and maximum drop height is 1.5 mm.

## 4. The DWS/DWM Ultra-Precise Oscillation-Displacement Instrument

This is a capacitance non-contact ultra-precise measurement instrument primarily for use in measuring mechanical oscillation and mechanical displacement, and it can also be used for measuring force, pressure, deformation, linearity, and thickness. It is especially suited to the measurement of the rotary accuracy of a shift; the moving accuracy of reciprocal structures; and the oscillation, displacement, and dimensions of precision components that cannot sustain force nor be scratched. On the foundation of the DWY3 Oscillation-Displacement Instrument that won a silver prize for invention at the 35th Eureka World Exhibition, this instrument has been further improved and perfected. Special non-linear compensation circuits and several other measures are used for its construction, which have resulted in such high performance characteristics as good linearity, high signal-to-noise ratio, broad frequency response, high resolution, small zero-drift, and high reliability for measurement precision; in addition, it is not affected by the length of the signal transmission cables. These performance specifications meet advanced international standards. Primary technical specifications: maximum resolution of 0.002 micron, maximum measurement range + over - 300 microns, working frequency range 0-7.5 KHz, non-linearity <0.5 percent, and zero drift <0.5 percent/hour. This instrument has been tested and approved by the China Institute of Metrology.

## 5. The JZ 3-Way Contact Sensor

Batteries are not needed for this kind of transducer, which can do contact testing in any direction X, Y, Z; repetitive testing error is less than 1 micron, which meets

advanced international standards for this type of product. The transducer is installed on the main shaft of the machine tool and can be used to true the workpiece, for positioning of the worktable, for monitoring of the accuracy of linear dimensions, and for prompt error compensation, and it can also be used for automatic tool alignment, monitoring of tool damage from abrasion, and for managing tool life. This will further improve the productivity and level of automation for NC machine tools, and is also a necessary corollary detector for ensuring operation of the machining center for long periods without breakdown, and even for unmanned operation. At present, there are two sensors: the JZ-1 for measurement and the JZ-D for tool alignment. During testing, maximum allowable travel for X and Y is  $\pm$  over 8 mm, and for Z it is 6 mm.

#### 6. The JCS-026Z High-Precision Cylindricity Instrument

This is a new-model cylindricity instrument recently developed by this institute not long after its introduction of the JCS-026 high-precision cylindricity instrument.

Aside from measuring cylindricity, the features of this instrument include such precision specifications as measuring cylindricity axiality, and linearity, and it can also do harmonic analysis; measured results can be output as either graphics or data, and they can also be stored on disk. This instrument includes an IBM general-purpose computer and a Federal Company (U.S. firm) amplifier and gauge head. The data processor uses the least-square (LSC) method and the minimum zone (MZO) method for evaluation; software processing speed is fast and quite accurate, and it can eliminate the fine offset and effects of inclination of the workpiece stand. The radial and axial bounce for this instrument averages 0.025 micron, and the linearity of the vertical guides is 0.3 micron/100 mm; the work platform can hold a workpiece of 40 kg.

In this paper we have summarized exhibits at the China International Machine Tool Exhibition, and have described several important achievements made during the past year by the Beijing Machine Tool Institute, which are available to everyone.

### Crystal Research Projects Proposed

40080201b Beijing BEIJING KEJI BAO [BEIJING SCIENCE AND TECHNOLOGY NEWS] in Chinese  
3 May 89 p 3

[Unattributed article: "Exploration of and Research on New Types of Non-Linear Crystals and Laser Crystals"]

[Text] With the development of high technology, the number of non-linear optical crystals and laser crystal materials of outstanding performance is increasing regularly. This fact has not only expanded the range of the frequency band that may be used by high-performance lasers, but has also shown more and more clearly their importance in laser communications, laser signal processing, and optical computing. For this reason research on the new types of non-linear optical crystals and laser crystals has attracted the attention of scientists throughout the world. The discovery and development of these new crystals is especially dependent upon the close integration of basic research in solid-state physics, solid-state chemistry, and materials science with materials synthesis and crystal-growth techniques. Research on these topics will play an important role in improving laser and optoelectronics technologies in China, and will at the same time advance China in those scientific disciplines.

Five subjects within this project will be the responsibilities of the following researchers: Professor Feng Rui [7458 3843] of Nanjing University, Professor Jiang Minhua [5592 3046 5478] of Shandong University, Researcher Chen Chuangtian [7115 0482 1131] and Assistant Researcher Luo Zundu [5012 6690 1653] of the Chinese Academy of Sciences' (CAS) Fujian Institute of Material Structure, and Researcher Tan Haoran [6223 3185 3544] of the CAS Shanghai Silicate Research Institute. Professor Feng Rui is the project head.

The primary research objectives of the project are:

1. To develop and perfect the theory of functional crystals among non-linear optical crystals that are organo-metallic complex compounds; to clarify the relations between microscopic basic elements and structure on the one hand and physical properties on the other; to find compounds to grow high-optical-quality compound single-crystals, and to study their growth techniques and basic laws; and to theoretically propose the design principles by which organo-metallic complex compound crystals become non-linear functional crystal devices. This objective also includes growing two or three new types of non-linear materials or laser materials that can be used.
2. To develop new lithium triborate frequency-doubling crystals for use with high-power Nd-doped lasers; to fully research the optoelectronic performance and applications future for the new type of non-linear optical crystal  $\text{Li}_2\text{B}_3\text{O}_5$ ; to study the mutual relations between the radical structures of boron-monooxide compounds and crystal

frequency-doubling coefficients, and to provide a theoretical basis for exploring new ultraviolet non-linear optical crystal materials; to provide a new ultraviolet non-linear optical crystal that can generate wavelengths shorter than 2,000 angstroms; and to systematically study the relations between radical structures of boron-monooxide compounds and their crystal linear and non-linear optical performance.

3. To explore and develop new polysynthetic polydomain crystal materials having micron and submicron cycles. To systematically research the excitation and propagation of electromagnetic waves and elastic waves, in one-dimensional cyclic structures with micron-level modulated wavelengths and also the photoacoustic linear and non-linear physical effects. By means of this research, to systematically clarify the excitation and propagation rules for light and sound in micro- and macroscopic one-dimensional cyclic structured crystals. To prepare high-performance laser frequency-doublers and ultrasonic acoustic devices using crystals of a given wavelength. To understand the effects of crystal defects and microstructure on physical properties, and to explore the preparation of new functional crystals with modulated structures.

4. To fully study the crystal fields and electro-acoustic coupling of high-valence cation-compound phonon terminal tunable laser crystals, both empirically and theoretically, from which to develop new materials with outstanding performance.

5. To understand the rules of distribution for doped ions in crystals and fluxes, and the effects on growth and performance; to clarify the mechanisms of light refraction; and to propose detailed studies of several light-refracting crystals for use in self-pumping phase-conjugation devices.

### Raman Scattering Studies of Optical Phonons in Semiconductor Superlattices

40090067a Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese  
Vol 7 Nos 5-6, Dec 88 pp 355-364

[English abstract of article by Wang Zhaoping [3076 0340 1627], Han Hexiang [7281 0735 4161] et al., of the Institute of Semiconductors, Chinese Academy of Sciences, Beijing]

[Text] The Raman scattering studies of  $(\text{GaAs})_n(\text{AlAs})_n$  superlattices at room temperature and under off-resonance conditions are reported. LO and TO phonon modes confined to GaAs and AlAs constituent layers have been observed in the proper scattering configurations. Based on the linear-chain model, the frequencies of optical phonon confined modes measured by Raman scattering are unfolded according to  $q = 2\pi m/[a_0(n+1)]$ . The optical phonon dispersion curve obtained by this method are in good agreement with those of bulk GaAs and AlAs.

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### Thermal Quenching of Photoluminescence for GaP:N Doped with Donor, Acceptor

40090067b Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese Vol 7 Nos 5-6, Dec 88 pp 371-377

[English abstract of article by Qian Youhua [6929 0147 5478], Ding Lei [0002 4320] et al., of the Department of Physics, Fudan University, Shanghai]

[Text] Through the measurement and analysis of bound exciton luminescence thermal quenching in GaP:N (Te, Zn), it is shown that the neutral Te atoms play an

important role in decreasing the NN pair luminescence quenching temperature relative to the undoped GaP:N by the "Auger blocking" effect of Te<sup>0</sup>. On the other hand, the doped Te enhances the distribution probability of electrons on isolated N atoms, resulting in an increase in the related luminescence quenching temperature of the isolated Ns. The latter phenomenon indicates that the Hopfield-Thomas-Lynch (HTL) model may be available for the isolated N center in GaP. In addition to the possible contribution to the relaxation of isolated N luminescence (peak A) quenching, the acceptor Zn supplies more holes due to photoexcitation at higher temperatures accompanying stronger luminescence from free excitons than do undoped GaP:N films.

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# **Regeneration, Laser Operation of $F_2^{\bullet}$ Centers in $LiF:OH^{-}$ Crystals**

40090067c Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese Vol 7 Nos 5-6, Dec 88 pp 397-402

[English abstract of article by Gu Hong'en [7357 3163 1869], Qi Lan [2058 5663] et al., of the Department of Physics, Tianjin University; Qi Lan [2058 5663] of the Department of Water Resources and Harbor Engineering, Tianjin University]

[Text] High density ( $\sim 10^{17} \text{ cm}^{-3}$ )  $F_2^{\bullet}$  centers in  $LiF:OH^{-}$  crystals bombarded by an electron beam at liquid-nitrogen temperature have been obtained.  $F_2^{\bullet}$  centers in colored  $LiF:OH^{-}$  crystals are efficiently converted into  $F_2^{\bullet}$  centers with densities of from  $10^{16}$  to  $10^{17} \text{ cm}^{-3}$  by irradiating the crystals with a nitrogen laser (337 nm) at room temperature. The stable laser operation of the  $F_2^{\bullet}$  centers in  $LiF:OH^{-}$  crystals has been realized at room temperature using a nitrogen laser as the processing beam.

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# **Studies of Optical, Magnetic Properties in $Cd_{1-x}Fe_xTe$ Semimagnetic Semiconductor**

40090067d Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese Vol 7 Nos 5-6, Dec 88 pp 419-424

[English abstract of article by Chen Chenjia [7115 6591 0857], Gao Wei [7559 5588] et al., of the Department of Physics, Beijing University; Ma Kejun [7456 0668 6511] of Shanghai Institute of Technical Physics, Chinese Academy of Sciences]

[Text] Measurements of the optical absorption in  $Cd_{1-x}Fe_xTe$  for  $x = 0.03, 0.06$  by transmission spectroscopy have been carried out and magnetization measurements in the temperature range of from 1.5 K to 30 K and for magnetic fields of up to 7T have been made by using the extraction method. It is shown that the band gap shifts toward the low energy side with an increase in  $x$ . Based on the mean field theory, a modified Brillouin function fits the data very well. It is demonstrated that there is an antiferromagnetic exchange coupling among the Fe ions.

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# **Effect of Annealing on Optical Properties of $a-Si_xC_{1-x}:H$ Films**

40090071a Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese Vol 8 No 3, Jun 89 pp 165-170

[English abstract of article by Tang Wenguo [0781 2429 0948], et al., of the Laboratory for Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences; Wang Fuchao [3768 1381 2600] of Zhejiang Agricultural University, Hangzhou]

[Text] The effect of annealing on the properties of infrared absorption (IR) and photoluminescence (PL) for  $a-Si_xC_{1-x}:H$  films has been investigated. The experimental results show that the IR related to hydrogen and the integrated PL intensities increase after annealing at

low temperatures, but decrease rapidly after annealing at high temperatures. At the same time, the peak energy positions of the PL spectra shift toward lower energies with the increase in the annealing temperature. The mechanism of the changes of the IR and PL properties caused by annealing is discussed.

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### Ring Cavity Optical Bistable System with Single Output Driven by Gaussian Beam

40090071b Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese Vol 8 No 3, Jun 89 pp 177-185

[English abstract of article by Fan Xijun [2868 6932 0689] of the Department of Physics, Shandong Normal University, Jinan; Tian Shufen [3944 0647 5358] of the Institute of Semiconductors, Shandong Normal University, Jinan]

[Text] The single output ring cavity optical bistable systems driven by a Gaussian beam are studied. The steady state equation is obtained and the linearized stability is analyzed under purely absorptive and resonant conditions using the mean field approximation. The results show that the steady state light intensity curves still exhibit a reverse S shape, but the unstable range in the case of the Gaussian beam drive is manifestly different from that of the plane wave beam drive.

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### Improvement of Autonomous Gate Center Tracker

40090071c Shanghai HONGWAI YANJIU [CHINESE JOURNAL OF INFRARED RESEARCH] in Chinese Vol 8 No 3, Jun 89 pp 197-202

[English abstract of article by Liu Zhili [0491 1807 4539] of North China Research Institute of Electro-Optics, Beijing; Yang Yihe [2799 1355 4421], et al., of the Department of Technical Physics, Xi'an Electronic University of Science and Technology, Xi'an, Shaanxi]

[Text] Based on the statistical model, this paper establishes the weight which describes the violent movement of the target and the strong disturbance. The compensation for those tracking situations is presented, and the IAGCT algorithm is established.

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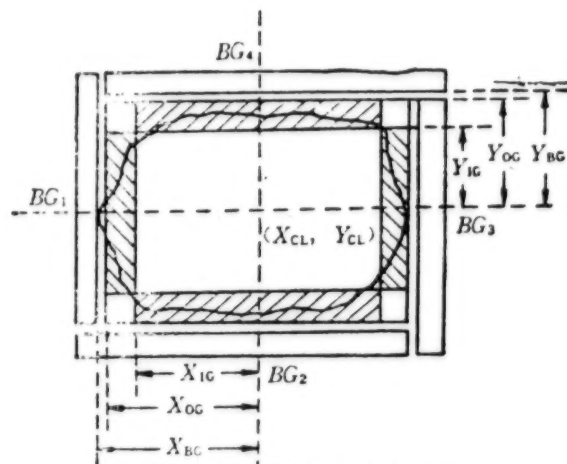


Figure 1. IAGCT Gate Structure.

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